

Robotics and Automation

High TRL Technologies for New Frontiers 4

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Core Capabilities



Satellite Communication Solutions
Connecting people and organizations across land, sea and air



ISR Systems
Multi-platform, multi-sensor systems for Intelligence, Surveillance & Reconnaissance

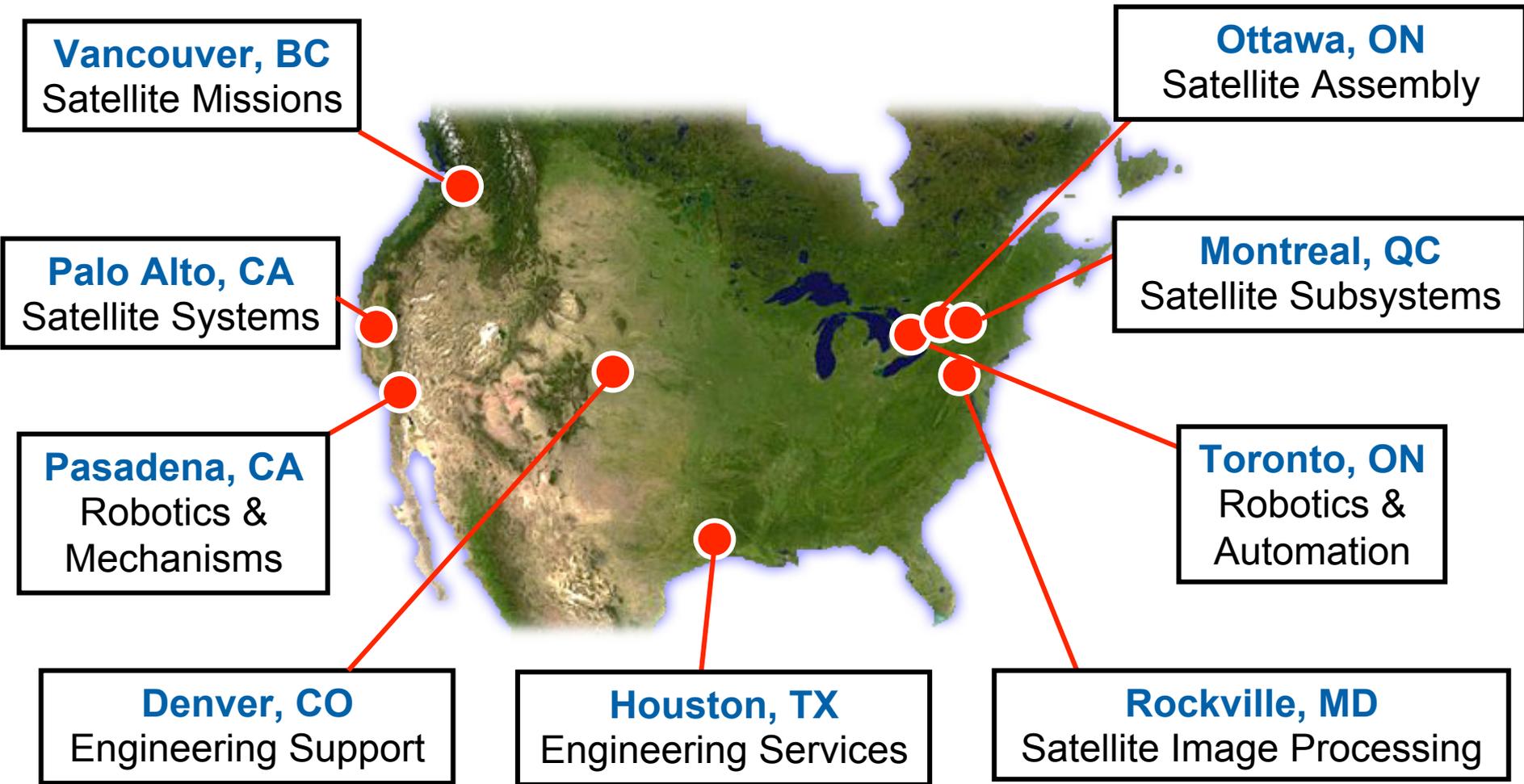


Geospatial Data & Services
Delivering timely multi-source geospatial intelligence products and services



Robotics and Automation
Extending human capability to perform challenging tasks in hostile environments

Corporate Footprint

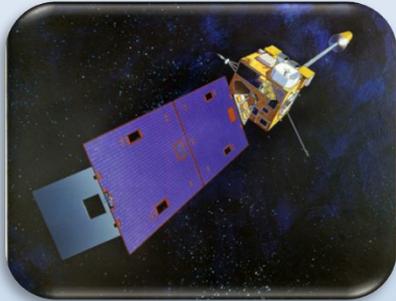


4500 employees worldwide, of which over 3000 are in the US



NASA Mission Heritage - Satellites and Subsystems

Satellites

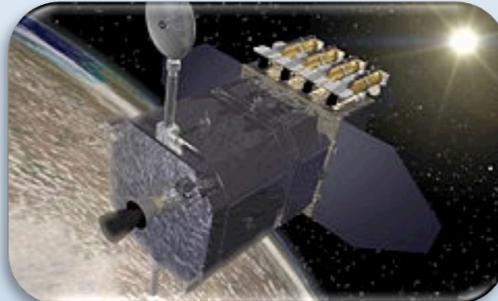


GOES 8 & 9
(NASA/NOAA)

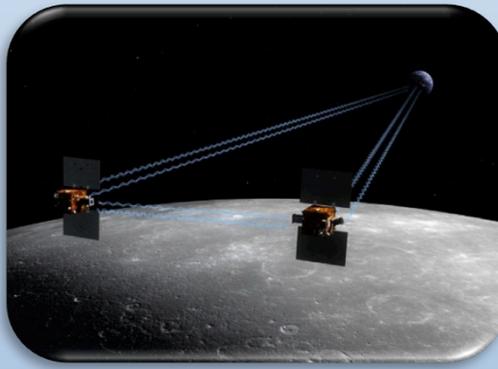


GOES 10, 11, 12
(NASA/NOAA)

Communications Subsystems

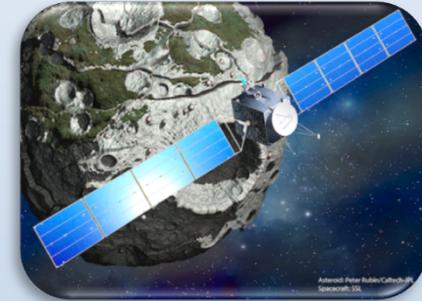


Solar Dynamics Observatory
Communications Subsystems
(2010)



GRACE and GRAIL
Ka-Band Communications
Subsystems (2011)

Bus & Power Subsystems



Psyche Solar Electric
Propulsion Bus



LADEE Composite
Bus Structure &
Propulsion System
(2013)



ISS Power System
Components (Batteries
and Sequential Shunt
Units)

NASA Mission Heritage - Robotics & Mechanisms

Robotics



InSight Robotic Arm
(Launch 2018)



MSL Robotic Arm (2011)



Mars Phoenix Lander
Robotic Arm (2007)

Credit: NASA
Credit: NASA



DAWN Mission Ion
Thruster Drive
Mechanism

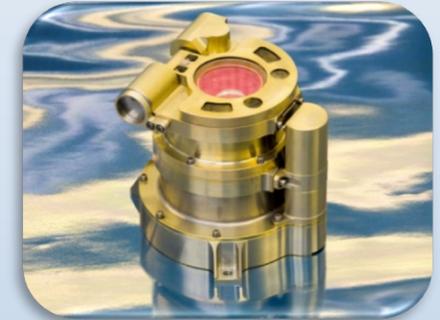


Mars Exploration Rovers
Instrument Deployment
Device (2003)

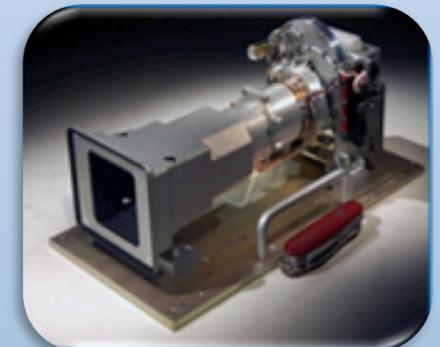


Mars '01 Robotic Arm Flight
Arm Delivered

Mechanisms



MSL MAHLI Optical Filter Wheel &
Focus Mechanism



MSL MastCam
Zoom Lens Assemblies

Mission Heritage – Canadian/CSA Contributions via MDA

Robotics & Mechanisms



International Space Station
Robotics (2011)



ESA ExoMars Rover Locomotion
Sub-system (Launch 2020)



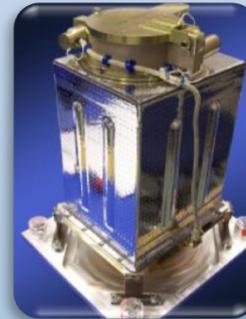
Science Instruments



OSIRIS-REx Laser Altimeter (2016)

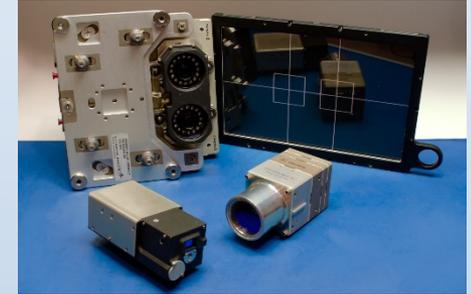


MSL Alpha-Particle
X-Ray Spectrometer (2011)



Mars Phoenix
Metrological Station
(MET) (2007)

Sensors

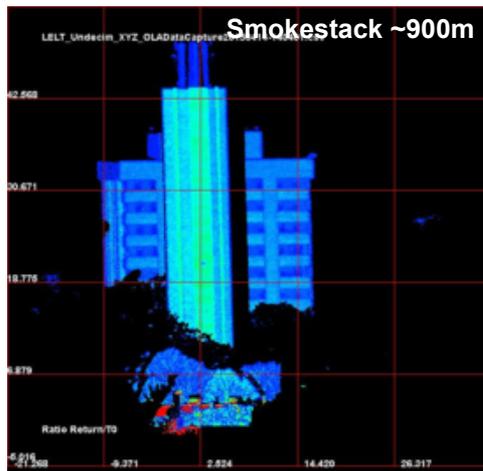


International Space Station
Cameras

Planetary Instruments – Lidar Systems



OLA is on-board the spacecraft and ready for launch to Bennu September 2016



Scientific and Operational Gains

Determine shape of asteroids/comets

- Insight into asteroid/comet density and internal structure when combined with radio science
- Detailed shaped models will support analysis of Earth-based telescopic data

Determine topography of planetary surfaces

- Provides ranging, shape modelling and topographic mapping capabilities
- Aids in understanding surface evolution

Supports spacecraft maneuvers for close proximity operations

- Range less than 10 m possible
- Determine safe rendezvous TAG points

Current OLA capabilities

- Maximum Range - 9 km
- Minimum Range - 0.04 km
- Scanner field of regard - $\pm 10^\circ$ azimuth, $\pm 6^\circ$ elevation
- Range accuracy - 0.06 – 0.3 m (1σ)

Planetary Payloads – Robotics and Actuators

Proven high reliability mission critical robotic systems for space exploration

- 30+ years of space robotic design, development and operations
- Enable challenging spacecraft-to-spacecraft contact operations under critical time constraints
- Control algorithms that allow for large scale manipulation, small fine scale delicate tasks, active damping and contact
- Integrated system analysis and simulation
- High torque density, mass-optimized actuators
- Custom tools for prepared and unprepared worksites
- Space qualified mechanisms for different environments

